Remarks

Claims 1-19 are pending, claims 1-15 and 18-19 stand rejected, and claims 16, 17 stand objected to. Claims 1-5, 8, 10-19 are amended by this amendment. Applicants respectfully traverse the rejection and request allowance of claims 1-19.

Regarding section 1 of the office action, the Applicants amended FIG. 1 to include "PRIOR ART".

Regarding section 2 of the office action, the Applicants amended claim 16 to properly depend from claim 15.

Regarding sections 3-4 of the office action, the Examiner rejected claims 1-9 under 35 USC § 112 as being indefinite. The Applicants amended claim 1 to remove the "operably connected" language. Amended claim 1 is definite under § 112. For instance, the hydrocarbon feedstock supply supplies feedstock to a hydrogen production system. The first flowmeter measures a flow rate of the feedstock supplied to the hydrocarbon production system. One skilled in the art would be able implement the hydrocarbon feedstock supply and the first flowmeter based on the language in claim 1. Thus, claim 1 is definite under § 112.

Regarding sections 5-6 of the office action, the Examiner rejected claims 1-15, 18 and 19 under 35 USC § 103 as being unpatentable over U.S. Patent 5,458,808 (Suggitt) in further view of U.S. Patent 5,259,239 (Gaisford). Suggitt teaches a system that uses the process of partial oxidation to separate out hydrogen. The system comprises an evaluating means (36), flowmeters (38), valves (42), and an apparatus (16,18,20) that receives and processes a feed gas (2,4,10), a synthesis gas (30), and an oxygen stream (6) to produce pure hydrogen (FIGS. 1,2; column 5, line 15 to column 9, line 15). The evaluating means attempts to maintain a design flow rate and a design hydrocarbon heat content entering the apparatus to maintain optimal performance (column 9, lines 46-67). To do this, the heat content of the feed gas stream (4) is measured and the evaluating system compares the measured heat content to the design heat content (column 9, line 46 to column 13, line 49). The evaluating means then uses the flowmeters to determine the flow rate of the feed gas and the synthesis gas (Id.). The evaluating means compares the flow rates to the design flow rate, and adjusts the flow rates using the valves. (Id.) With the flow rates and the heat content optimized, the apparatus

works more efficiently.

Gaisford teaches a multiphase hydrocarbon mass meter that can measure the mass of a multiphase flow.

Amended claim 1 of the pending application differs from Suggitt and Gaisford, and any combination thereof. Claim 1 describes a controller that processes a mass flow rate of a hydrocarbon feedstock to determine an estimated carbon content of said hydrocarbon feedstock, and controls a steam flow rate and/or the hydrocarbon mass flow rate based on a ratio of the estimated carbon content and the steam. Neither Suggitt nor Gaisford teach processing a hydrocarbon mass flow rate to determine an estimated carbon content of a hydrocarbon feedstock. Also, neither Suggitt nor Gaisford teach controlling flow rates based on a ratio of the carbon content and steam. Suggitt does not even mention measuring a mass flow rate, and consequently cannot teach processing a mass flow rate to determine an estimated carbon content. Also, Suggitt teaches the process of partial oxidation (not steam reformation), wherein oxygen is added to the process. With oxygen added, there is no direct ratio of carbon content and steam that would be useful in controlling the partial oxidation process. For the invention in amended claim 1, the ratio of steam to carbon content can advantageously be used to control flow of the hydrocarbon feedstock and/or the steam to improve the production of hydrogen. Thus, claim 1 is allowable over Suggitt and Gaisford, and any combination thereof. Claim 10 is allowable for similar reasons. Claims 2-9 and 11-19 are allowable as being dependent on an allowable independent claim.

The Applicants submit that there may be additional reasons in support of patentability, but that such reasons are moot in light of the above remarks and are omitted in the interests of brevity. The Applicants respectfully request allowance of claims 1-19.

The Applicants believe that no fees are due. However, any additional fees may be charged to deposit account 03-1725.

35010/127

Respectfully submitted,

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Version with Markings to Show Changes Made

In the Specification

The following represent marked-up versions of the amendments made to the specification.

The paragraph on page 1, beginning on line 25:

Hydrogen gas production by the SRH method involves reacting a hydrocarbon feedstock with steam. In general, hydrocarbon feedstocks contain a variety of hydrocarbons, and the reaction chemistry proceeds according to ideal stoichiometric equations for each type of hydrocarbon. A [a] variety of different reactions occur, depending upon the feedstock. The most important reactions can be generally categorized as:

A. Dehydrogenation of cyclohexanes to yield aromatic hydrocarbons;

B. Dehydrogenation of certain paraffins to yield aromatics;

C. Isomerization including the conversion of straight-chain to branched chain carbon structures, such as octane to isooctane;

D. Reformation of methane in natural gas to produce carbon dioxide and hydrogen; and

E. Reformation of naptha to yield synthetic natural gas.

The paragraph on page 5, beginning on line 18:

One such embodiment of a mass flowmeter system comprises a hydrocarbon feedstock supply for supplying a hydrocarbon feedstock to the hydrogen gas production system. A steam supply is used to supply steam to the hydrogen production system. A mass flowmeter is operably connected to the hydrocarbon feedstock supply for measuring a hydrocarbon mass flow rate therein and for producing a hydrocarbon flow rate signal representing the hydrocarbon mass flow rate. A second flowmeter is operably connected to the steam supply for measuring a steam flow rate and for producing a steam flow rate signal representing the steam flow rate. A controller is operable for receiving the hydrocarbon flow rate signal and the steam flow rate signal. The controller has program instructions for

controlling a ratio of the hydrocarbon feedstock and the steam delivered to the hydrogen production system.

The paragraph on page 7, beginning on line 11:

Fig. 3 is a schematic diagram of process control instructions for use [.in] in a controller governing operation of the system shown in Fig. 2; and

In the Claims

The following represent marked-up versions of the amendments made to the claims. All of the claims are presented, amended or not, in order to avoid confusion in the event of future prosecution.

1. (Amended) A mass flowmeter system for use in controlling a reformation reaction in a hydrogen production system, said mass flowmeter system comprising:

a hydrocarbon feedstock supply for supplying a hydrocarbon feedstock to said hydrogen production system;

a steam supply for supplying steam to said hydrogen production system;

a [mass] first flowmeter [operably connected to said hydrocarbon feedstock supply] for measuring a [hydrocarbon] mass flow rate of said hydrocarbon feedstock supplied to said hydrogen production system, and for producing a hydrocarbon flow rate signal representing said [hydrocarbon] mass flow rate of said hydrocarbon feedstock;

a second flowmeter [operably connected to said steam supply] for measuring a [steam] flow rate of said steam supplied to said hydrogen production system, and for producing a steam flow rate signal representing said [steam] flow rate of said steam; and

a controller operable for receiving said hydrocarbon flow rate signal and said steam flow rate signal, the controller having program instructions for processing said mass flow rate of said hydrocarbon feedstock to determine an estimated carbon content of said hydrocarbon feedstock, and controlling at least one of said flow rate of said steam and said flow rate of said hydrocarbon feedstock based on a ratio of said [hydrocarbon feedstock] estimated carbon content and said steam delivered to said hydrogen production system.

2. (Amended) The mass flowmeter system of claim 1 wherein said [mass] <u>first</u> flowmeter [is] <u>comprises</u> a Coriolis mass flowmeter.

3. (Amended) The mass flowmeter system of claim 1 wherein said second flowmeter [is] comprises a [second] mass flowmeter.

4. (Amended) The mass flowmeter system as set forth in claim 3 wherein said second [mass] flowmeter [is] <u>comprises</u> a Coriolis mass flowmeter.

5. (Amended) The mass flowmeter system of claim 1 wherein said program instructions include instructions for adjusting [a] <u>said</u> ratio [of said steam mass flow rate to said hydrocarbon mass flow rate, the hydrocarbon feedstock having] <u>for</u> a plurality of hydrocarbon fractions.

6. (Unchanged) The mass flowmeter system of claim 5, wherein the program instructions include instructions for determining said ratio from a correlation based upon a measured physical parameter of said hydrocarbon feedstock.

7. (Unchanged) The mass flowmeter system of claim 6, wherein said measured physical parameter comprises density.

8. (Amended) The mass flowmeter system of claim 7, wherein the [mass] <u>first</u> flowmeter [is] <u>comprises</u> a Coriolis flowmeter operable for performing a density measurement, and the Coriolis flowmeter is operable for providing said controller with a signal representing said density measurement.

9. (Unchanged) The mass flowmeter system of claim 5, wherein the program instructions include instructions for using said ratio as a constant.

10. (Amended) A method of operating a mass flowmeter system for use in steam reformation of hydrocarbons processing where a hydrogen production system is in use, said method comprising the steps of:

measuring a mass flow rate of a hydrocarbon feedstock delivered to said hydrogen production system to provide a hydrocarbon mass flow rate measurement;

measuring a [second] flow rate of steam delivered to said hydrogen production system to provide a steam flow rate measurement; [and]

processing said hydrocarbon mass flow rate measurement to determine an estimated carbon content of said hydrocarbon feedstock; and

controlling at least one of said flow rate of said steam and said flow rate of said hydrocarbon feedstock based on a ratio of said estimated carbon content and said steam delivered to said hydrogen production system [controlling the amount of said hydrocarbon feedstock and said steam delivered to said hydrogen producing system based upon said hydrocarbon mass flow rate measurement and said steam flow rate measurement].

11. (Amended) The method according to claim 10, wherein said step of measuring a mass flow rate of said hydrocarbon feedstock comprises measuring said mass flow rate of said hydrocarbon feedstock using a Coriolis mass flowmeter to obtain said hydrocarbon mass flow rate measurement.

12. (Amended) The method according to claim 10, wherein said step of measuring a [second] flow rate of steam comprises measuring said flow rate of said steam using a [second] mass flowmeter.

13. (Amended) The method according to claim 12, wherein said [second mass flowmeter is] step of measuring a flow rate of steam comprises measuring said flow rate of said steam using a Coriolis mass flowmeter.

14. (Amended) The method according to claim 10, further comprising [wherein said step of controlling comprises] adjusting [a] said ratio [of said steam mass flow rate to said

hydrocarbon mass flow rate] for a plurality of hydrocarbon feedstocks.

15. (Amended) The method according to claim 14, wherein said step of controlling at least one of said flow rate of said steam and said flow rate of said hydrocarbon feedstock based on a ratio [includes] comprises determining said ratio from a correlation based upon a measured physical parameter of said hydrocarbon feedstock.

16. (Amended) The method according to claim [16] 15, wherein said measured physical parameter comprises density.

17. (Amended) The method according to claim 16, wherein said step of measuring a mass flow rate of a hydrocarbon feedstock comprises measuring said mass flow rate using [meter being] a Coriolis flowmeter operable for performing a density measurement, and further comprising a step of obtaining said density by direct measurement from said [mass] Coriolis flowmeter.

18. (Amended) The method according to claim 10, wherein the step of controlling occurs contemporaneously with said steps of measuring said mass flow rate of said hydrocarbon feedstock and measuring said [second] flow rate of said steam.

19. (Amended) The method according to claim 10, comprising repeating said steps of measuring said mass flow rate of said hydrocarbon feedstock and measuring said [second] flow rate of said steam while said step of controlling is underway.